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Jean Simon Bonnemain (1743-1830) and the Origins of Hot Water Central Heating

Emmanuelle Gallo

At the origin of this presentation is the “Mémoire sur le régulateur du feu”, which consists of drawings and written descriptions in a sealed envelope registered by Jean Simon Bonnemain at the French Academy of Sciences on 14 August 1782. Bonnemain is generally known as the inventor of hot water central heating in the historical literature (Bernan 1845, Vetter 1907, Bruegmann 1978, Elliot 1992), and this contribution is an opportunity to discover more about him and his work. Presented here are the results of original research in archives and libraries, on periodical publications and specialised dictionaries and collected biographic information. A chronological table is given which presents and organizes all the elements found on Bonnemain’s life, works and knowledge diffusion, in parallel with the text.

Working on Bonnemain reveals two paradoxes: firstly, he is a well-known inventor in the fields of heating and regulation. Yet, before this research was begun, we knew little more than his last name, not even his date of birth and death. Bonnemain is thus famous yet unknown. Secondly, he is recognized as an important contributor to the history of heating though his major invention was a regulation system. He applied this technology to several devices including a chicken incubator machine; hot water heating was just one of these.

Chronological table

Year	Events and activities <i>Profession</i>	<i>Address</i>
1743	Probable birth of Jean Simon Bonnemain	
1777	The Academy of Sciences nominates Daubenton and Desmaret to report on Bonnemain’s observations on chicken birth and hatching egg (AS Daubenton, 26 April)	
1778-1793	Production of chickens with artificial incubation by Bonnemain, stopped by food shortage during the French Revolution (Bonnemain, p. 24)	<i>In the outskirts of Paris</i>
1782	Reports on Bonnemain’s studies on the way for hatching eggs and rearing chickens artificially and his regulation system to heat (AS Daubenton, 3 and 14 August) Description and sketches of his heat regulator (AS Bonnemain, 14 August)	
1782-1783	Request for a royal privilege for building, selling and retailing an heat regulator applied to a portable stove to incubate eggs and breed chicks and an economical cooking stove for twelve	

Year	Events and activities	Address
	pound of meat cooked in four hours (AN F/12/2432, October 1782, February 1783)	
	<i>Physicist - engineer</i>	<i>Lived in Paris</i>
1783	Royal privilege of 15 years for Mr Bonnemain's heat regulator grants by a royal decree on 12 March 1783 (AN E2734)	
1784	Leaflet on heat regulator and its applications on greenhouses, baths, stoves, kitchen stove (SRM191 dr30 n°1)	
	<i>Physicist</i>	<i>Cloître St-Jacques de l'hôpital, Paris</i>
1787	Bonnemain answers to questions in the "Salon de la correspondance pour les sciences et les arts", of the <i>Nouvelles de la République des Lettres</i> , on heating with regularity 24 litres of mercury in an opened glass vase	
	<i>Physicist – engineer</i>	<i>Cloître St-Jacques de l'hôpital, Paris</i>
1788	Favourable report by the Royal Society of Medicine on Bonnemain's proposal to apply the heat regulator to heat constantly a bathtub, 12 hours long (SRM191 dr30 n°1)	
1791	Bonnemain obtains a pension (200 or 300 francs) as destitute artist, following a decree from the National Assembly (AN F/12/2424)	
1792	A heating apparatus is ordered to Bonnemain by Mr Regnier for a farm he owned on 227 rue de Mantoue facing the Monceau Gardens. Application of Bonnemain heat regulator and hot-water circulation to heat flats (CNAM N71)	
1792	Report on a still with the application of Bonnemain's heat regulator (CNAM X24)	
1795 an 3	Bonnemain is mentioned in the additional members listing of the <i>Lycée des Arts</i> (<i>Annuaire du Lycée des Arts an 3</i> , p.173)	
	<i>Chemist - engineer</i>	
1796	Bonnemain is mentioned as member of the <i>Lycée des Arts</i> (<i>Annuaire du Lycée des Arts an 4</i> , p.76)	
	<i>Engineer</i>	<i>Nanterre</i>
1798 an 4	Bonnemain takes part to the first Industrial Fair (only 110 exhibitors), in the Champs Elysées in Paris with stoves, stills and other improved ustensils (<i>Première exposition publique des produits de l'industrie Française</i> , p. 5.)	
	<i>Physicist</i>	<i>Nanterre close to Paris</i>
1798	The journal <i>Magasin Encyclopédique</i> reports the list of exhibitors, including Bonnemain at the first Industrial Fair in France (<i>Magasin Encyclopédique</i> , p. 399)	
1799	Bonnemain is mentioned as member of the <i>Lycée des Arts</i> (<i>Annuaire du Lycée des Arts an 6</i> , p. 165)	
	<i>Engineer</i>	<i>Paris, rue Helvétius au coin de celle de Louvois</i>
1799 an 7	Reports on the council meeting of the teachers at the Natural history Museum on the experiments done by Bonnemain to grow asparagus in a greenhouse in winter (by request of the Interior Minister). And a file with documents related to this experience, expenses and compensations (a total of 3 018 francs) and a letter from Mr Lefebvre to Mr Jussieu, 1er Thermidor, to prompt the payment of Bonnemain who was facing financial problems (AN AJ/15/582, Jussieu, p. 321-9, Bonnemain, p.26)	

Year	Events and activities <i>Profession</i>	<i>Address</i>
1800	Report on a lecture at the <i>Lycée des Arts</i> by Delunel on using Bonnemain's heat regulator for melting suet as saving fuel and labour (<i>Magasin Encyclopédique</i> , p. 406)	
1805 an 12	Report of the free society of agriculture in the Seine department on the need to save wood as a fuel, the CNAM and the Société d'Encouragement pour l'Industrie Française are in charged of promoting the inventors like Franklin, Rumford, Désarnod, Bonnemain (CNAM N151)	
1806	File on the application of Bonnemain's heat regulator to l'Abbé Brolle method to retting hemp (CNAM U57)	<i>Nanterre</i>
1807	Deposit at the CNAM of an hydraulic stove by Bonnemain, payed 84 francs for it by Mr Molard, administator of the CNAM (CNAM N129)	
1808	In the <i>Bulletin de la Société d'Encouragement</i> Delunel describes the use of Bonnemain's heat regulator to a double boiler for melting suet and saving charcoal in a farm in the faubourg Saint-Denis (Delunel, p. 154-162)	
1808	File on the use of Bonnemain's heat regulator to the purpose of pulling silk, with a letter asking for more money because he had to pawn his machine for living (CNAM U750)	
1808	Bonnemain received 400 additional francs to finish the stove he already started with 600 francs. His system would be given to the CNAM at the end of the experiments (<i>BSEIF</i> , p. 236)	
1808-1809	Files on a project of hydropyric engine based on the dilatation of metals and the circulation in turn of hot and cold water, total budget 2000 francs (CNAM A349) (CNAM P71) (CNAM A349)	<i>Nanterre</i>
1809	Sketches and description of a stove to cook and crystallize beetroot sugar Bonnemain declares having a clean place to experiment at a real scale (CNAM T113) <i>Engineer – Physicist</i>	<i>Nanterre, near Porte Dauphine</i>
1809	Application of Bonnemain's heat regulator, and hot water stove for laundering by Shoppler and Hartman in Augsburg (<i>BSEIF</i> , 1850, p. 31)	
1814	The Royal Agriculture Academy, through Mr Bore report rejects Bonnemain's proposal for hatching eggs and rearing chickens artificially (ARA, Bore)	
1815	Andrew Ure (1778-1857) professor of chemistry at the University of Glasgow, meet Bonnemain who is giving private instructions relative to the construction hot-water stoves and artificial incubation (Ure 1839, p. 40)	
1816	Bonnemain publish a booklet on how hatching eggs and rearing chickens artificially, with a subscription system to teach how to drive the devices of different sizes (Bonnemain, 32 p.) <i>Physicist, author of several inventions and discoveries</i>	<i>372, rue St-Honoré, Paris</i>
1822	Bonnemain's works are quoted in the section "Sanitation" in the <i>Dictionnaire technologique</i> by Anselme Payen (1795-1871), professor of chemistry at the CNAM, who thought that Bonnemain was already dead. Afterwards , Bonnemain contacted Payen (<i>Dictionnaire Technologique, vol. 2</i>)	
1823	Bonnemain shows eight machines at the industrial exhibition: heat regulator, different hot water stoves (copper or iron sheet), stove for bath (AN F/12/991)(Thury, p. 369)	<i>6, rue des Deux-Portes-Saint-Jean, Paris</i>
1823	Bonnemain's hot-water system of warming apartments with heat regulator is described section "Heat" in the <i>Dictionnaire Technologique</i> (<i>Dictionnaire Technologique, vol. 4</i>)	

Year	Events and activities <i>Profession</i>	<i>Address</i>
1823	Bonnemain owns a house, a building, a garden and a piece of land in Nanterre, in a place named <i>Le champs aux Melles</i> , now match with the area between the streets des Venêts and Victor Hugo, rue Raymond and avenue Joliot-Curie, South East from the original centre of the village (AD Hauts-de-Seine, 3P2/NAN_11)	
1824	Three systems invented by Bonnemain are presented in the <i>Bulletin de la Société d'Encouragement</i> : how to heat baths or liquid, how to incubate eggs and breed chicks artificially, how to heat greenhouses. He received financial encouragements for the deposit of his drawings and description to the Society (<i>BSEIF</i> , p. 238-42) <i>Engineer – Physicist</i>	<i>6, rue des Deux-Portes-Saint-Jean, Paris</i>
1827	The section “Artificial Incubation” in the <i>Dictionnaire Technologique</i> is drawn up under the direction of Bonnemain (<i>Dictionnaire Technologique</i> , vol.11)	
1827	Bonnemain shows his machines at the industrial exhibition and received a silver medal (Thury, p. 409)	<i>2, rue des Deux-Portes-Saint-Jean, Paris</i>
1828	After a report on Bonnemain’s invention and the large applications of his heat regulator, the Council of the <i>Société d'Encouragement</i> gives him a silver medal. Applications quoted: chicks incubator, heating flats or rooms for sick people, heating space for fermentation, heating greenhouses, distilling wine, concentrating liquids, washing linen, treating salted matter, manufacturing glue, heating hop for beer (Payen, p. 181-2) The <i>Moniteur Universel</i> , “the” newspaper of the period took up the news on Bonnemain’s work and silver medal (<i>Le Moniteur Universel</i> , p. 854)	<i>6, rue des Deux-Portes-Saint-Jean, Paris</i>
1828-1829	Bonnemain appears in the list of stove and chimney makers in <i>l’Almanach du Commerce</i> : fire places, central heating, kitchen stoves, incubator (<i>Almanach du Commerce</i> 1828, p. 203, 1829, p. 235)	
1830	Jean Simon Bonnemain dies in Nanterre on Sunday 15 January (AD Hauts-de-Seine 5MI/NAN_5)	<i>Nanterre</i>
1833-1835	File by request of Mrs Bonnemain (Jean Simon’s widow) for financial help to the King and later to the Ministry of education and sciences, with a description of Bonnemain’s contributions to knowledge and practical applications, apparently without success (AN F/17/3123) <i>Physicist - Engineer</i>	<i>Nanterre</i>
1840	Description of an incubation system using Bonnemain’s heat regulator perfected by Mr Sorel. This device, owned by Mrs Rousseau, is located in Le Pecq near Saint-Germain-en-Laye (<i>BSEIF</i> , p. 254-5)	
1841	Mr Borne uses a Bonnemain’s incubator in Paris rue des Veuves and in Ternes suburb (Valcourt, p. 249)	
no date	Economic cooker with Bonnemain’s heat regulator, coloured wash drawing (CNAM Industrial Portfolio Inv. 13571.333.)	
no date	Model of Bonnemain’s chicken incubator (CNAM Inv. 00847-0000)	

BIOGRAPHICAL FACTORS

Biographical tracks were tenuous, over an extended period fraught with radical political events. Collecting publications allows us to list his successive addresses and to know he had reached the age of eighty-five by May 1828 (Payen 1828). He appears to have lived in Paris (from 1782) and in Nanterre (from 1795), to the west of the capital. Thus, Jean Simon Bonnemain, probably born in 1743, died on 15 January 1830 in Nanterre (AD 5MI/NAN_5), where he owned a house, a garden, a piece of land and a building probably dedicated to his work (AD 3P2/NAN_11, CNAM T113). We do not know where Bonnemain was born and what kind of studies he carried out, we do know that his handwriting was excellent. He was married and left a widow aged 67 (AN F/17/3123). The doctor and chemist Andrew Ure (1778-1857), who met Jean Simon Bonnemain around 1815 gave this description:

He was then a stout hale man, about seventy-two years of age, of the most amiable complacency of manners, and well acquainted with all the interesting inventions of the day. Many an instructing promenade I had with him. He was ever ready to conduct the curious stranger to see whatever was most novel in science and art, terminating his round of visits at the Jardin des Plantes.

(Ure 1839, p. 40)

His longevity is noteworthy, especially considering the troubled period through which he lived. This longevity allowed him to develop thorough works, but was accompanied by recurrent financial problems (AN F/12/2424, CNAM N129, *BSEIF* 1808, p. 236). Bonnemain had to give up his chicken manufacture during the revolution, because of a corn shortage and because his customers stopped having dinners or were forced to emigrate (Bonnemain 1816, p. 24). Once, he was not able to finish a machine because he had to pawn it for his subsistence (CNAM U750). Dr. Ure testified:

Every body esteemed him, and sympathised with his misfortunes. At a subsequent period, a petition was presented to the French government, signed by many distinguished savants, soliciting a small pension for the venerable octogenarian.

Mrs Bonnemain herself wrote about her husband's situation:

Mr Bonnemain was already old when he had to give up his manufacture, and he used his last years to perfect his different systems, which obtained the approval of scientists like d'Arcet, Molard aîné et Payen, Thouin et Vauquelin. Mr Bonnemain, absorbed by study, neglected the care of his fortune or when he was again able to turn his attention to it, it was too late to restore.

(AN F/17/3123)

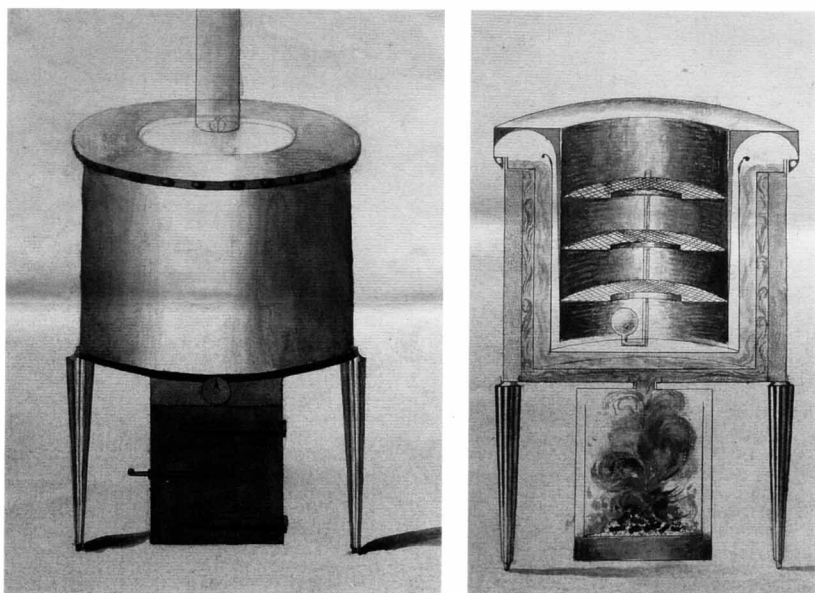
Philippe Grouvelle, an important heating manufacturer of the second part of the nineteenth century in France, wrote that Bonnemain's misfortune was not caused by the revolution but by all the costs of the failed attempts inventors have to make (Grouvelle 1847). All these difficulties do not seem to have affected his determination:

Mr Bonnemain never gives up finding himself new implementations to his discoveries, although 84 years old he still spreads his ideas with determination and disinterestedness which deserve praises.

(Thury 1828, p. 40)

HIS WORK AND ITS DISSEMINATION DURING HIS LIFETIME

Bonnemain's first proposal to the Academy of Sciences consisted of a heat regulator and a system for hatching eggs and rearing chickens artificially. He asked for a royal privilege (French system anterior to the patents in 1791) to protect his inventions and obtained it. As a mechanical engineer he was able to develop the practical means, but he also added long and precise studies of the conditions of natural poultry reproduction; in order to copy them properly: heat, humidity and their allowed variations, how the chick breaks the shell and so on. The temperature has to be as constant as possible, which is allowed by the heat regulator as the heat is conducted by hot water (**fig.1 & 2**). This invention oriented on producing food can be considered as a civil act in the eighteenth century French context, where most novelties were related to primary goods (Hilaire-Perez 2000, p. 52).



Figures 1 & 2. Bonnemain's artificial incubator (AS pli 222 14 août 1782).

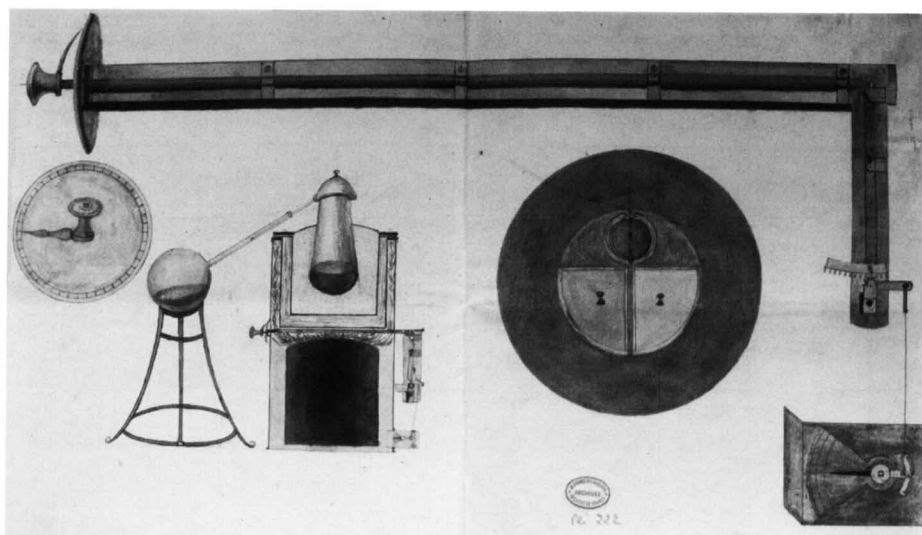


Figure 3. Bonnemain's heat regulator (AS pli 222 14 août 1782).

The heat regulator consisted of a double rod in iron and in brass; the difference of heat expansion of the two metals was responsible for the movement (**fig.3**). The rod connected to a lever, opened and closed a door to adjust the air intake in the furnace changing the fire intensity. The rod was also connected to a face to fix the temperature. The rod was passed through the stove above the furnace. This system allowed a constant heat and a certain running time and can also be used different ways. Bonnemain promoted this heat regulator, though he ran a chicken manufacture from 1778 to 1793 (Bonnemain 1816, p. 24). In the sealed envelope registered in the Academy of Sciences, Bonnemain lists the different applications: greenhouses, bath, carriage heating (AS, 1782).

Another application of the heat regulator was a kitchen stove, with a drawing in the industrial portfolio collected in the Conservatoire National des Arts et Métiers (**fig.4**). It was a kind a pressure-cooker with the pot above, with the furnace underneath and the regulator in between. This system, destined for use by the Army, made it possible to cook 12 pounds of meat in four hours (AN F12/2432).

Bonnemain distributed a promotional paper listing the different applications of his heat regulator: greenhouses, baths, heating stoves, kitchen stoves (**fig.5**), but he also answered questions submitted in *La Nouvelle République des Lettres*, on how to heat with regularity 24 litres of mercury in an open glass vase. He contacted the Royal Society of Medicine and proposed an adjustable heating system for bathtubs functioning over a period of twelve hours. Practical experiments were conducted and the water stayed at the desired heat. The regulator was located in the tub so, if cold water was poured in, the temperature changed and released the opening of the door, letting in the air from the furnace placed underneath.

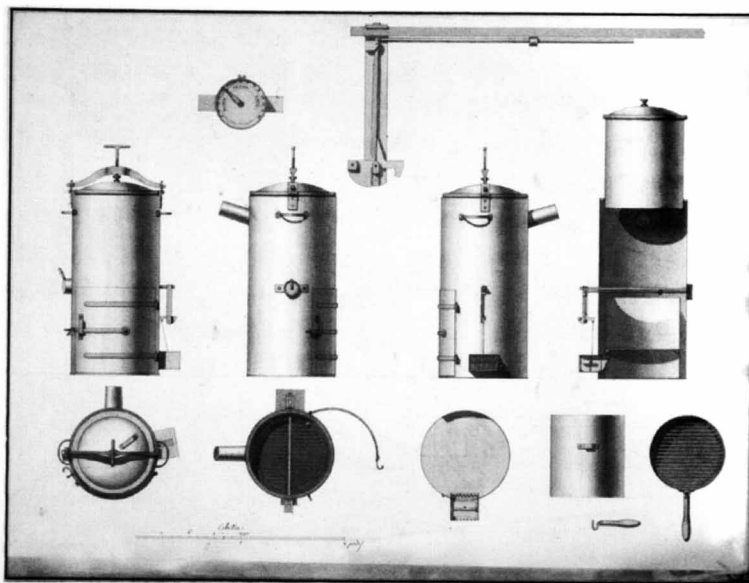


Figure 4. Bonnemain's cooking stove (CNAM Industrial Portfolio Inv. 13571.333).

OBJET D'ÉCONOMIE.

RÉGULATEUR DU FEU.

LE SIEUR BONNEMAIN, particulièrement livré à l'étude de la Physique, & déjà connu par l'art de faire éclore des Poulets & de les élever sans le secours des Poulx, a trouvé le moyen d'obtenir une chaleur toujours parfaitement égale, & à tel degré qu'il veut, par l'application d'un Régulateur qu'il adapte aux Foyers, Poêles, ou autres Utensiles propres à contenir le Feu.

Il a soumis son invention à l'examen de l'Académie des Sciences, fut le Certificat de laquelle il a obtenu du Roi, par Lettres-Patentes, enregistrées au Parlement, le Privilège exclusif de vendre & débiter toutes les Machines auxquelles il applique son Régulateur.

Cette invention manquée aux Chymistes, qui souvent desirerent pour leurs opérations une précision que le feu de lampe lui-même ne peut pas leur procurer.

Le peuple d'annoncer son peu de tems, dans un Prospectus, la multitude d'avantages dont l'usage du Régulateur ferait pour la Chymie, pour les Serres chaudes, pour les Bains, pour les Poêles, pour la cuisson des Aliments, & généralement pour la perfection de tous les Arts, où le Feu, employé pour agent, a besoin d'être tempéré, & entretenir toujours au même degré.

Ces avantages sont de trois espèces : l'économie dans les matières servant d'aliment au feu ; la commodité, en ce que le Régulateur dispense de tous soins de surveillance sur le feu ; la sûreté, en ce que son feu parfaitement certain d'égalité continuant du feu.

Le bon usage aujourd'hui à annoncer qu'il a appliqué son Régulateur à des Poêles & à des Cuisinières, dans lesquelles on peut faire cuire en même-tems différents Aliments ; l'usage de ces Cuisinières ne laissera rien à désirer pour la commodité & pour la justesse de la cuisson des Aliments.

Et si l'on peut s'y à la Chaudière & en Voyage.

Pour s'affranchir le Public contre les contrefaçons, le Sieur BONNEMAIN avertit que toutes les Machines auxquelles il aura appliqué son Régulateur, seront numérotées & marquées de son Poisson, dont l'empreinte est déposée au Greffe de la Police de Paris.

Il prie ceux qui lui écrivent, d'adresser leurs Lettres au sieur BONNEMAIN, Physicien, Cloître St-Jacques de l'Hôpital, & de les adresser.

Permis d'imprimer & distribuer, ce 8 Juin 1784. LE NOIR.

De l'Imprimerie de CLOUSIER, rue de Soissons.

OBSERVATIONS

SUR L'ART DE FAIRE ÉCLORE ET D'ÉLEVER LA VOLAILLE

SANS LE SECOURS DES POULX

OU

EXAMEN des causes qui ont pu empêcher de donner suite aux diverses tentatives qui ont été faites en Europe, pour imiter les Egyptiens dans l'art de faire éclore et d'élever les oiseaux domestiques de toutes espèces, par le moyen d'une chaleur artificielle; suivi des procédés qu'il faudrait employer pour amener cet art à sa perfection.

PAR M. BONNEMAIN,

Physicien, auteur de plusieurs inventions et découvertes, Membre de l'Académie des Arts, et autres Sociétés d'Arts et Métiers.

Prix : 1 franc.

A PARIS,

À l'ancien, rue Saint-Honoré, n° 322 : CHEVALIER, Opticien-Opticien de S. A. R. Monsieur, vis-à-vis le Marché aux Fleurs ; DURAND, Architecte des jardins, Directeur des modèles et curiosités de Mr le duc de Berry, rue de Bussy, n° 19, et rue Jarente, derrière le marché Sainte-Catherine, au Marais, n° 6 ; CHAUGNIEAU jeune, Imprimeur-Libraire, rue Saint-André-des-Arts, n° 41 ; MARTINET, Libraire, rue du Coq Saint-Honoré ; Et tous les Marchands de Nouveautés.

1816.

Figures 5 & 6. Bonnemain's promotional leaflet (SRM191 dr30 n°1) - Bonnemain's booklet (Bonnemain 1816).

In 1799, at the request of the Interior Minister François de Neufchateau (1750 -1828), for the teachers at the natural history museum, Bonnemain proposed to grow asparagus in a greenhouse in winter (Jussieu 1799). The successful experiments attracted visitors and the official report was published in the widely disseminated monthly revue *La Feuille du Cultivateur*. Other applications of Bonnemain's heat regulator were subsequently developed: a still, an apparatus for melting suet (*Nouvelles Littéraires* 1800, CNAM N71). The regulator was also applied to l'Abbé Broille's method of hemp retting, to a double boiler for melting suet, to a stove to cook and crystallized beetroot sugar, and to regulate a stove for laundering (CNAM U57, Delunel, 1808, p. 154 - 62, CNAM T113, *BSEIF* 1850, p. 31).

In 1808, Bonnemain, using the expansion of metal and the circulation of hot and cold water, created an engine: gathered brass rods are exposed alternately, by swinging, to hot or cold water, which maintained the movement. This system moved during twelve hours with 50 litres of water in the tank without the risk of steam bursting. This original idea did not seem to have had any future.

The first mention of an application in the heating of buildings appeared in a manuscript archive in 1792 (CNAM N71) with regard to the heating of a farm facing the Monceau gardens (Paris). In 1823, Bonnemain's hot water stove presented in the *Bulletin de la Société d'Encouragement* could be used for heating spaces with hot water circulating with a slight difference of temperature in a circular duct. Even if this application was one among others in the author's career, it was one with promise for the future, especially because Bonnemain as a mechanical engineer solved all the practical details.

The perspective of saving fuel and using coal was also a great concern in this period politically and economically disturbed with supply issues.

Even whilst involving himself in a productive private enterprise with poultry, Bonnemain regularly engaged in scientific communications with official and academic institutions (table). With his membership in the Lycée des Arts (*Annuaire du Lycée des Arts*, 1794-8) and his participation at the first Industrial Fair in France among 110 other exhibitors (*Première exposition publique des produits de l'industrie française* 1798, p. 5), he took his place in the scientific and technician circle. Untiringly he presented his heat regulator and his various applications to obtain official recognition, first from the Academy of Sciences and also to obtain the "royal privilege", but he never registered any patents after 1791 (INPI). Proposing experiments to scientific societies was also a way for Bonnemain to spread his ideas. The wide scope of applications of his heat regulator induced contacts with the Academy of Sciences, the Royal Society for Medicine, the Natural History Museum, the Conservatoire National des Arts et Métiers, the Royal Agriculture Academy, and the Société d'Encouragement. Meanwhile, he maintained personal exchanges with Claude-Pierre Molard (1758-1837) administrator at the CNAM from 1800 to 1818.

Bonnemain's written production consisting of a booklet on poultry incubation was relatively minor in the light of the importance of his practical production (**fig.6**), and was very likely in answer to an unfavourable report by the Royal Agriculture Academy. The interest in artificial incubation arose after the return of Napoleon's scientific team from Egypt, where they discovered there traditional chickens "ovens" (Bret 1999). In 1823, Count Thury expressed in his report on the Industrial Fair his hope that Bonnemain could publicise his inventions (Thury 1824, p. 369). Two publications transmitted Bonnemain's works, the *Bulletin de la Société d'Encouragement* and the *Technical Dictionary*. In which Anselme Payen, a chemist (1795-1891), the author of the section on heat, sanitation and artificial incubation, described the hot water stove and the new improved version of the chicken incubator with a "poussinière" illustrated by a plate (**fig.7**) (Payen 1822, 1823 1827).

The active dissemination of Bonnemain's inventions, even at an advanced age, is impressive, even if his motivation by then was necessity of income. He took part in the two Industrial Fairs of 1823 and 1827, at the age of 80 and 84 years old, and received a silver medal at the last one, for his entire production. He received another silver medal from the Société d'Encouragement in 1828, in recognition of his achievements.

HIS NATIONAL AND INTERNATIONAL RECOGNITION UNTIL PRESENT TIMES

It is noteworthy that Jean Simon Bonnemain was clearly identified as a founding father of hot water central heating in France as well as in the German speaking countries and the Anglo-Saxon world. In France, the first series of papers referring to Bonnemain's inventions after his death, were presentations of the implementation of the heat regulator and an improvement of the poultry incubator in a close continuity of his works (Valcourt 1841, p. 249, *BSEIF* 1840, 1851). Then, came a new generation of heating manufacturers like Philippe Grouvelle and the Duvoir brothers (Léon & René) who may have had direct contacts with Bonnemain especially when he taught how to drive the heating system of his inventions. They developed central heating in public buildings from 1830 and Philippe Grouvelle clearly pays tribute to Bonnemain in the *Laboulaye's Arts & Crafts Dictionary*. He recognised him as a pioneer of hot water heating and described the heat regulator and the chicken incubator very precisely. Louis Figuier also referred to Bonnemain in his presentation of novelties in applied sciences, but with distance and mistakes (Figuier 1871, Vol. 4, p. 315-6).

Maubras, in his lecture at the Ecole Centrale, a pioneering school in the instruction of heating methods, dated the first hot water heating in 1777, with Bonnemain's first presentation to the Academy of Sciences (Maubras 1908, p. 468). At that stage, Jean Simon Bonnemain became a symbol of French innovation in the field. Le Pecq, near Saint-Germain-en-Laye, where Bonnemain made a chicken incubator for Mrs Rousseau, perfected by Mr Sorel and still functioning in 1891, became a kind of Mecca of hot water-heating systems (Grouvelle 1891, 7th edition), even if the experiments of Bonnemain were most probably carried out in Nanterre.

In parallel, Andrew Ure introduced Bonnemain and his works to the English reading area with three pages in the *Architectural Magazine* (Ure 1838, p. 39-41), he described the chicken incubator very precisely with the help of an engraving (**fig.7**) (coming from the *Dictionnaire Technologique* 1827), and mentioned the heat regulator and hot water heating system. Walter Bernan, in his two volume historical presentation of heating buildings, referred to doctor Ure's paper, adopting the idea that the Marquis de Chabannes borrowed Bonnemain's inventions for his warming systems (which is debatable) (Chabannes 1815 & 1818).

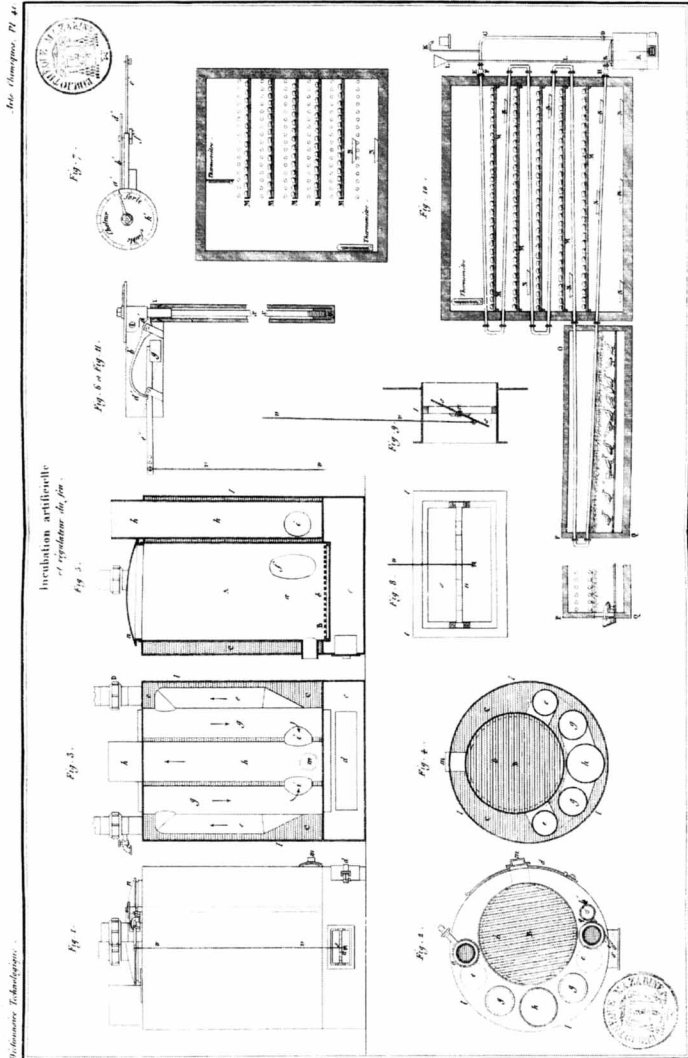


Figure 7. Bonnemain's hot water stove and chicken incubator (*Dictionnaire Technologique*, vol. 11).

In Germany, Hermann Vetter wrote a summary on the history of central heating and in the section dedicated to hot-water systems, Bonnemain's works were detailed from his first contact with the Academy of Sciences in 1777 to his poultry manufacture and the heating systems for greenhouses, baths, flats and other applications (Vetter 1907, p. 20-4). Vetter referred to different sources: the *Dictionnaire Technologique*, the *Bulletin de la Société d'Encouragement*, and the brochure written by Bonnemain himself. Vetter is used as a reference to recent historian's approaches on heating (Ronner 1991, p. 28).

English language historical studies on heating in the twentieth century also quoted Bonnemain (Dufton 1941, p. 103, Bruegmann 1978, p. 148, Elliot 1992, p. 280). Robert Bruegmann detailed his sources: Academy of Sciences, Royal Society of Medicine, *Feuille de l'agriculteur*, Grouvelle's paper on heat regulation. But surprisingly, the illustration of the chicken incubator supposed to have been made in the 1770s, presented also in Vetter's paper, used a plate from the *Dictionnaire Technologique* published in 1827 (**fig.7**), causing a historical distortion (Payen 1827). Elliot quoted Bonnemain from the report to the Academy of Sciences and from Vetter's German paper.

It is interesting to see how specific knowledge was spread around Europe and North America through technical literature (periodicals and dictionaries) rather quickly and then transmitted by "disseminators" like Mr Vetter, Ure and Bernan, despite language barriers.

In the course of this research, I discovered that Bonnemain was also quoted in regulation history, as the creator of a noteworthy mechanical heat regulation system for his time (Mayr 1970, p. 132-3, Remaud 2004, p. 34-5).

CONCLUSION

During Bonnemain's lifetime, other inventors like Désarnod concentrated more on heating than he did (Désarnod 1789). But his heat regulation system and hot water network allowed continuous heating and hours of running time, with promise for the future. Bonnemain as a mechanical engineer controlled the practical details of his machine and was able to pass this ability to others.

The invention of a system to produce goods and its subsequent application to the technologies of comfort is a recurrent phenomenon in the history of heating. Jean Simon Bonnemain with his incubator and later his system for heating space is another example of this pattern. Bonnemain with his inventions contributed to progress and aroused sympathy and recognition amongst scientists and engineers, before becoming an historical reference.

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